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ABSTRACT

Six museum education and learning researchers discuss the need to study how people learn and behave in museums and what kind of current research studies should be undertaken. Mary Ellen Munley, in "Back to the Future: A Call for Coordinated Research Programs in Museums," describes the differences between the terms "evaluation," "audience research," and "education research" and recommends establishing major systematic programs of museum-based research that are similar to ones initiated in the 1920s and 1930s. In "Educational Exhibitions: Some Areas for Controlled Research," C. G. Screven believes that priority should be placed on more and better empirical studies undertaken in museum settings, while John and Mary Lou Koran propose the development of a model based on cognitive philosophy and tested through studies and simulations of museum learning in "A Proposed Framework for Exploring Museum Education Research." Robert Wolf, in "The Missing Link: A Look at the Role of Orientation in Enriching the Museum Experience," suggests that new information about museum learning is not likely to be discovered and believes efforts should be directed toward issues such as the mechanics of visitor orientation. In "Computers Everywhere: But What Has Happened to the Research?" Patricia McNamara discusses the need to discover new ways to use computers for learning and uses research about visitor utilization of museum computers as an example of what can be accomplished and what is not currently being done with museum research. (JHP)

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Museum Education Research: Future Directions

In this issue:

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Computers Everywhere—But What Happened to the Research

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Museum Education Research: Future Directions

It was with great relish that we suggested to *The Journal of Museum Education* the topic of this issue. As museum learning researchers, we have been heartened by the increased awareness within most, although certainly not all, quarters of the profession for improved understanding of how people learn and behave in museums. The real catalyst for this issue though, was the AAM's Commission report *Museums for a New Century*. The commission outlined a number of steps required by the profession for dealing with the issue of learning in museums, including "a stronger commitment to research into the distinctive character of museum learning." In order to seriously confront and ultimately benefit from this challenge for more research, the museum profession needs to address the issue of what kind of research is really needed. Accordingly, this issue of *The Journal of Museum Education* has posed this question to six leading researchers of museum learning.

One of the biggest difficulties museum researchers face when discussing their results before museum audiences is one of semantics—specifically, what do we really mean by visitor research? Mary Ellen Munley appropriately deals with this issue in her paper, where she distinguishes between "evaluation," "audience research," and "education research." The core of her article, though, is a recommendation for establishing major systematic programs of museum-based learning research, not unlike ones initiated in the earlier part of this century.

Papers by Chandler Screven, John and Mary Lou Koran, and Robert Wolf provide interesting counterpoints. Drs. Screven, Koran, and Koran present the perspective that recent research has only begun to provide some tantalizing ideas of how people learn in museum-like settings. Screven believes that priority should be placed on more and better empirical studies done in the museum setting, which can become the foundation for a generalized theory. Koran and Koran prefer to develop a model first, based on cognitive psychology. They would test their model through studies of learning in the museum setting and simulations of the museum setting. Dr. Wolf, also a cognitive psychologist, feels that little new information is likely to be forthcoming to change our notions of learning in museums. He thinks that it would be better to place our energies on issues such as the mechanics of visitor orientation.

Finally, Patricia McNamara takes a very targeted approach to the question of future directions in museum research. She uses research on museum computer use as an example of what can, and currently is not, being done with research in the museum setting. It is fair to generalize from her paper that not only are research opportunities being squandered in the area of computer use but in virtually any other museum domain one could mention.

In conclusion, we would like to add our own, necessarily abbreviated, opinion. We feel that in order for significant improvement to occur in our understanding of the museum visitor experience, basic definition/perception shifts have to occur in two very fundamental areas—learning and the visitor.

In the area of learning, we need to remove ourselves from the formal education mind-set that makes us equate "learning" with "facts and concepts." The cognitive domain of facts and concepts (the world of school) although important, does not encompass the totality of "learning;" it is merely a subset. Learning is a process that represents an organism's way of discovering, and storing for the future, useful information about the world. The information can be, and frequently is, related to feelings, culture, attitudes, or skills. All of these information areas require learning, and museums, like schools, are settings in which such learning can occur. To suggest that learning is only cognitive in nature does a disservice to both museums and to those who wish to study people within them (a view shared by Screven and the Korans). All facets of learning need to be studied, and since this has not been the case in schools, it will require many new techniques and approaches. In this regard, museum learning researchers can provide real leadership.

The second area where museum professionals need to change their mind-set relates to the visitors—who they are, and how the museum visit fits into their lives. Too often, researchers (including us) have treated the one to two hours of a museum visit as an identifiable, quantifiable, and thus, dissectable, part of an indi-

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THE JOURNAL OF MUSEUM EDUCATION: ROUNDTABLE REPORTS

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Back to the Future: A Call for Coordinated Research Programs in Museums

by Mary Ellen Munley

Research about learning in the museum has received little attention. By measure of activity alone the practice of museum evaluation has fared better. When asked if their museums conduct evaluations, nearly all museum professionals respond in the affirmative. It has become nearly axiomatic. Evaluation is central to sound management and decision making and has therefore become a part of responsible museum management.

Though these reports are encouraging, there is something unsettling about both the discussion and practice of evaluation and audience research in museums. My discomfort begins with definitions. We are not all talking about the same thing when we use the terms "evaluation," "audience research," or (as the theme of this journal announces) "education research." For me, these terms represent three different types of activities, and as I listen to how museum professionals use the terms I find they carry even more meanings.

Evaluation as it is most commonly practiced refers to a process of self-analysis and review—an activity central to quality performance by professionals. Thus, it is difficult to imagine a museum that does not engage in this type of evaluation of its programs and exhibits. The staff do consider whether their offerings are good or bad, whether they meet appropriate standards, and whether they are proud of their efforts.

By tradition evaluation has taken on another meaning in the museum setting. And this second type of evaluation activity is less commonly practiced. Evaluation has come to describe all systematic efforts to examine the effectiveness of exhibits and programs from the perspective of the audience. Evaluators systematically track visitors' patterns through exhibits, determine which parts of an exhibit attract and hold interest, and interview visitors about their reactions to specific exhibits and programs. Such careful analysis of programs is commendable, but it is not research.

Similarities and differences between evaluation and research are worth remembering. Both evaluation and research attempt to describe the museum setting, to trace out sequences of behavior, and to understand the relationships between visitors and museum offerings. Both use research methods to gather information, and each may even make use of experimental design in an effort to compare, for example, performance by comparable groups before and after viewing an exhibit or by groups exposed to different types of interpretative strategies.

Methods and subject matter do not distinguish evaluation and research. Evaluation and research differ in intent. Evaluation is intended to gather information that will be of immediate value. An evaluation can help a staff modify an interactive exhibit or can assess a program's success in meeting stated goals. Questions to be answered by an evaluation are based on the information needs of museum decision makers. Evaluators work in the actual setting of a program or exhibit; they deal directly with program planners and presenters and report their results to those same people in whatever form is most appropriate.

Research is quite different in intent. Research is driven by a generalized desire to know more. There may not be an immediate need for the findings, and research questions are more likely to come from the researcher or from a theoretical proposition intriguing enough to suggest testing and possible confirmation. Research requires methodological rigor. Research requirements influence decisions about sampling, location, and study procedures. Results tend to be widely disseminated through publications in an effort to contribute to theory development and a growing body of knowledge.

Probably the best examples of research studies in a museum setting were initiated in 1925. In that year a group of Yale professors, including the renowned psychologist, Edward Thorndike, suggested a psychological study of the public museum. An initial grant to the American Association of Museums (AAM) by the Carnegie Corporation of New York allowed Edward S. Robinson of Yale University to conduct a ten-year program of research about visitor behavior in the museum.

Robinson and his associate, Arthur Melton, involved several notable museums in their research. In a speech at the 1926 annual meeting of the American Association of Museums in New York City Robinson announced that "no real progress could be made in the understanding of the educational operations of the public museum until one or two institutions should be willing to modify their exhibits and labels for experimental purposes." His challenge was met by Mr. Chauncey J. Hamlin, president, Buffalo Museum of Science and Mr. Fiske Kimball, director, Pennsylvania Museum of Art in Philadelphia. Further grants from Carnegie to the AAM (Arthur Melton was a research associate on staff at the AAM during the early 1930s) and then to Yale University allowed for fairly elaborate experimental studies at the Buffalo Museum of Science, the Pennsylvania Museum of Art, and other museums including the

Peabody Museum of Natural History and the Newark Museum.

In 1935, ten years after they began, Robinson and Melton published a monograph, *Problems of installation in museums of art*. This seminal volume reported the results of years of research in several different museums. Their monograph was one in a series of AAM publications edited by Robinson called the New Series.[1]

The work of Robinson, Melton, and their associates abruptly stopped in 1936 with the publication of the New Series monograph number 15, *Experimental studies of the education of children in a museum of science*. A review of programs from AAM annual meetings show that they gave their last presentation in 1935, and nothing from the group appears in *Museum News* or any other museum publication after 1936.

There has been no similar major, systematic effort to study the public museum since Robinson and his associates' efforts in the 1930s. Instead, efforts have been scattered and emphasis has switched to evaluation and the more practical focus on program modification and assessment of program effectiveness. The result is a muddled view of both evaluation and research, and little idea of what we do know about visitor behavior in the museum.

It is our current good fortune that interest is turning once again to the museum's responsibility to its audiences and to interest in research. Although there has been a span of several decades since the last coordinated research effort, the stage is set now to resume the kind of audience research pioneered by Robinson and his colleagues. Interest in visitors, their behavior, and learning in the museum is at an all-time high. People are beginning to see that museum education is not confined to special programs designed by the education department. The team approach to exhibit development suggests that a good exhibit is not only substantively strong, aesthetically pleasing, and communicative. It must also be attentive to visitors' expectations and needs for learning. *Museums for a New Century*[2] calls on museums to examine their potential as learning environments and to articulate their distinctive contribution in the realm of object-based, informal, voluntary, and lifelong learning. A commission recommendation explicitly calls for research about museum learning.

In the commission report, leaders of the profession embrace learning as a defining element of the museum. The museum's responsibility to learning, like its responsibility to collections, requires commitment, resources, and constant attention. More and more curators, administrators, and exhibit designers seek information from audience studies that might inform their decisions. However, we have not yet developed adequate answers for the kinds of questions being asked about museum as learning environments—and that is a shame.

We no longer need to convince good people that learning is an important part of the museum experience. Our challenge is to get a research program organized so that we can explore the questions already dominating professional conversations. We need a systematic effort to determine what is already known about learning in the museum and then to develop programs of research to further extend that knowledge. This is what must be done:

(1) *Conduct a review of extant evaluation and research findings.* Museum evaluation and visitor research is an applied science. Justification for the activity rests on its contribution to improved practice. Virtually hundreds of evaluations and scores of research studies have been conducted in museums. But the results of the investigations are known to very few people. Information is embedded in hundreds of published articles and perhaps thousands of occasional papers from conferences and reports of studies whose results were prepared only for a particular museum.

Before we embark on new avenues of research—and to guard against conducting research to answer questions already sufficiently addressed—I propose that time and resources be devoted to finding out what we already know. A bibliography—even an annotated one—is not sufficient. Museum practitioners need critical reviews of existing literature. Studies are varied in quality, sophistication, and applicability to the museum setting. The reports need to be reviewed for methodological rigor, and separate findings need to be synthesized. If evaluation and research are to be accepted as necessary to responsible program development then practitioners must see their usefulness. Talking about the intrinsic value of research will not win the day. Presentation of evaluation and research results in a format that makes them interesting to exhibit designers, educators, and curators will.

(2) *Establish a clearinghouse for evaluation and research.* There needs to be a place where study reports can be gathered, abstracted, and catalogued. Through a clearinghouse professionals could gain access to studies and be kept informed of research and evaluation activities in museums across the country. Equally important, the clearinghouse could compile and disseminate information about evaluation procedures and research methods. The clearinghouse needs a location, a carefully designed computer system, and sufficient staff to assure that records of research activities are current.

(3) *Develop a systematic program of research.* The evaluation literature is teeming with intriguing concepts and fascinating hypotheses just waiting for prolonged research. At the most, a typical evaluation is conducted over a six-month period in a museum. Issues for the investigation are tied to a specific exhibit or program, and evaluators are usually cautious about generalizing findings beyond the specific program or exhibit being evaluated. As a result, there is little carry-over of concepts and research questions from study to study.

In my own work, evaluations have produced ideas worthy of further study. I have identified concepts and speculated about explanations for visitor behavior, but given the restrictions of evaluation, it has been impossible to pursue

investigation of these hypotheses in any depth. It would be interesting to know, for instance, if the hierarchy of information needs we found among visitors in an exhibit about eighteenth-century tools[3] would be replicated in other settings.

In that same study we found that attention to particular parts of an exhibit were gender determined. Women, for instance, would look at cases full of items used in an eighteenth-century kitchen while men looked at cases full of lighting fixtures and farm equipment. Furthermore, we observed that the groupings of objects in the exhibit seemed to encourage the tendency of the sexes to go separate ways. As the exhibit was designed, men rarely viewed artifacts traditionally used by women. The reverse was also true. While it is clear that the sexes had very distinct responsibilities in the eighteenth century, grouping objects by primary user is not the only option. Perhaps more visitors would attend to the objects if they were arranged using an organizing concept such as time of day.

This observation proved stimulating to the museum staff. But it also suggests a research program focused on experimenting with object groupings so that the museum might combat visitors' limited viewing unconsciously guided by social norms.

Taking a broader, more theoretical perspective regarding what happens in museums, several questions for research present themselves. What might museums contribute to knowledge about visual learning and visual literacy? What might behavior in the museum teach us about self-directed learning? And, what would longitudinal studies tell us about developing aesthetic sensibility and cultural sensitivity during a lifetime? The museum is a natural setting for such investigations.

(4) *Identify museums willing to serve as laboratories for the study of museum learning specifically and informal learning generally.* Research about museum learning must be conducted in a museum setting. Museums will need the counsel of research methodologists as they begin their studies, but the research initiative and research activities need to come from museums. Currently there is not a single museum in this country with a program for research about visitor behavior and learning. Only a handful of museums have committed resources to evaluation activities. Until a few museums take the lead and begin to support and carry out audience research, we will see little progress.

(5) *Create a place for social scientists on the museum staff and train people for the position.* A person responsible for directing evaluations or an audience research program in the museum must have museum experience and must have formal training in a social science, including training in research methodology.

Traditionally, research and evaluation efforts in the museum have been marred because the principal investigator was not properly trained. Many studies use sound methodology, but they fail because the focus for the study is inappropriate and lacks sensitivity to the special features of museums as learning environments. The emphasis in most evaluation studies on visitors' comprehension of label copy is a prime example of the limitation of studies designed by people familiar with more formal learning environments where mastery of words is important. Museums are about objects, yet very few evaluations or research studies concentrate on how and what visitors learn from objects.

Knowledge of research methods, principles of questionnaire construction, sampling, and statistics is necessary for any person directing a museum evaluation or research program. In addition, the evaluator or research director must be a highly skilled participant observer and interviewer. Again, many existing study reports are of little value because the procedures used to gather information are so suspect that conclusions drawn from them lack validity.

In addition to methodological expertise, training in a social science provides theoretical foundations for thinking about visitors' museum experiences. Statements of hypotheses and analysis of research findings are influenced by the knowledge of the researcher. In my opinion, graduate training should include the study of perception, interpersonal communication, and ways of knowing. I feel that understanding the content and relational parts of every message, individual differences in tolerance for ambiguity, and the influences of attitudes, beliefs and values on perception are necessary for making sense of what is observed in a museum exhibit or program.

A new kind of expert is needed in the museum. Training programs need to be established so that people with museum experience can learn about social science research and theory. Conversely, a program is needed to acquaint interested social scientists with the museum setting before they actually plan evaluations and design research studies.

A Modest Agenda for Research

Research efforts need a conceptual direction, and several research agendas suggest themselves; I am committed to two in particular:

Ethnographic research We still have simple questions to ask about visitor behavior. And until we have a more thorough understanding of the nature of visitors' experiences and expectations for museums, highly sophisticated hypothesizing and investigations strike me as premature. Again, I return to 1928 and Edward Robinson's thoughts on directions for museum research:

> "When first the possibility suggested itself of a scientific study of the behavior of the museum visitor there was talk of refined physiological technique. There were thoughts of catching the visitor before and after his artistic or scientific excursion and of determining subtle differentials of blood pressure, pulse rate, respiration, and psychogalvanic reflex. Almost surely some facts could have been had in such manner—

and almost surely nobody would have had the slightest idea what to do with them."[4]

Just as in the 1930s, we still have much to learn by a careful study of museums modeled on the ethnographic work of anthropologists and sociologists. I suggest that our questions should stem from basic curiosities. For me, that means that I'm still asking: What do people do when they come to the museum? How long do they stay? What do they look at? What do they pass by? What are they hoping to see? And what does looking at objects and artifacts mean to visitors?

Identification of appropriate outcome variables

Determining the appropriate and measurable results of museum visits is not a new issue, but it is critical. Most studies take a limited view of visitors' museum experiences. Typically, evaluation studies measure effectiveness by tallying visitors' satisfaction ratings for a particular exhibit or program. Less frequently, but still quite common, are studies that determine effectiveness by measuring changes in levels of knowledge about an exhibit's topic. Usually these measures focus on acquisition of new information and facts. A few studies examine changes in visitors' attitudes while in the museum.

Longer term effects of museum visits are virtually unexplored. Nearly all studies are designed to get information from visitors immediately after they experience a program or exhibit. And rarely do investigations systematically chart changes in curiosity, enthusiasm, or delight for something as a result of a museum experience. These are serious omissions.

Museum professionals and museum evaluators and researchers need to talk about what should be considered indicators of successful museum experiences. Anyone who works in a museum or has visited a museum knows that the experience is not adequately described by a report of new facts that were learned—the experience is more complex. Our evaluations and research need to reflect that complexity.

Conclusion

First priority needs to be given to finding out what we already know about visitors, visitor behavior, and the interaction between visitors and museum offerings. We need a critical review of existing literature and publications that can be available to museum educators, exhibit designers, administrators, and curators.

Some museums must be willing to establish research programs and devote adequate resources to them. The profession needs to recognize the need for a new area of museum expertise and create museum research training programs for experienced museum professionals and social scientists.

And as research and evaluation programs begin to develop and flourish, we must not lose sight of the aim of museum audience research. We cannot let it become an esoteric field of inquiry. It must always help professionals to become thoughtful, well-versed students of the museum as an important educational institution for lifelong learning.

Notes

1. The AAM New Series included the following reports: Margurite Bloomberg, *An experiment in museum instruction*, New Series, Number 8, 1929; Arthur W. Melton, *Problems of installation in museums of art*, New Series, Number 14, 1935; Mildred C.B. Porter, *Behavior of the average visitor in the Peabody Museum of Natural History Yale University*, New Series, Number 16, 1938; Edward S. Robinson, *The behavior of the museum visitor*, New Series, Number 5, 1928.
2. Commission on Museums for a New Century, *Museums for a New Century* (Washington, DC: American Association of Museums, 1984).
3. Mary Ellen Munley, *Telltale tools: An experimental exhibit* (Washington, DC: Smithsonian Institution, National Museum of American History, Department of Social and Cultural History, 1982).
4. Edward S. Robinson, *The behavior of the museum visitor* (Washington, DC: American Association of Museums, New Series Number 5, 1928), 9.

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Educational Exhibitions: Some Areas For Controlled Research

by C.G. Screven

Introduction

It is generally assumed that museums have great potential as places for informal learning (Falk 1985). Progress has been made in recent years toward making museums more viable as alternative educational environments for the general public. But much more needs to be learned about what makes these settings work or not work as learning environments. The primary "learners" in museums are unguided visitors who are exploring the museum environment on a voluntary basis and on their own terms. What they learn can be verbal, visual, emotional, or social, and can involve new ways of thinking about things, changes in readiness to learn, interests, attitudes, motivation, sensitivities, and so on. Whatever learning takes place is *informal*, not the formal learning of school settings. Informal learning is nonlinear, self-paced, voluntary, and exploratory. In museums, unlike schools where the primary teaching tool is the teacher supported mainly by *verbal* media, the primary teaching tool in the museum is the exhibition supported by objects and other visual media (Screven 1986). These differences require approaches that are radically different from those employed in schools and other formal settings.

How the physical and visual design of educational exhibitions potentially affect the motivational, perceptual, affective, and cognitive learning of unguided museum visitors is not well understood. Systematic research that might provide definitive answers has not been done. Substituting for this research are interesting and sometimes useful working hypotheses about how visitor interest, attention, cooperation, and cognitive learning are influenced by such variables as lighting, color, conceptual preorganizers, question strategies, participation, and discovery activities. These usually are based on loosely-defined theoretical models taken from the psychology of learning, perception, motivation, memory, information processing, educational technology, and instructional design. The underlying empirical data for these models derive mostly from experiments in behavioral laboratories and school-related issues in formal learning (text design, classroom formats, verbal learning, etc.). These are obtained under much different conditions than the voluntary, self-directed learning taking place in open, free choice exhibit environments.

The author has recently outlined (Screven 1986) some educated guesses applicable to some aspects of exhibit planning and design. Others can be found in the growing literature on educational exhibit design (see Screven 1984). But many applications seldom work at first and must undergo trial and error adjustment through the formative evaluation process. And, once working, the results seldom apply in the same way when applied without modifications to another exhibit situation.

Much work needs to be done to more carefully examine these working hypotheses under more controlled conditions to reliably predict what visitors will or will not learn, perceive, feel, or do in a given exhibit situation. These include the identification of important questions for research that may help bridge the gap between research and theory in the behavioral sciences and the practical needs of museums; developing a framework to enable museums to work in cooperation with universities where the needed expertise in psychological and educational communications research is usually found; identifying methods for doing research in museums, especially methods of attacking a broader range of questions—e.g., the impact of exhibit experiences on visitor actions outside the museum and generalized exhibit effects (thinking skills, sensitization, learning to learn, etc.). Research designs presently used (mainly pre-post test designs using independent random samples) limit the interpretations that can be made.

This paper focuses on the first of these tasks—defining some (by no means all) of the questions that need to be investigated. These areas for investigation are not aimed at testing "theories" of learning, cognitive development, visitor need systems, or at generating theories. In the writer's opinion, the immediate priority is more and better empirical information and, at most, relatively low levels of inductive generalizations. Good theoretical models for informal learning are indeed important, but given the present lack of empirical information, it may be better to focus on the empirical information that can become the foundation for such theory.

Among the many possibilities, four areas will be discussed which probably should be among any list of topics for systematic research. All have face validity from behavioral and educational research and have implications for educational exhibit design. Various educated assumptions in these four areas are implicitly or explicitly involved in current approaches to educational exhibit design, but there is a dearth of empirical evidence that can be used either to confirm or reject these assumptions. The remaining part of this paper will briefly discuss each of these areas and some of the questions involved in each.

Area 1: Unguided Museum Audiences.

Various characteristics are commonly attributed to and assumed about unguided museum audiences which, if valid, have implications for how exhibitions are designed and integrated within the museum. Some of these probably are givens; for example (a) visitors are leisure audiences visiting on their free time and interacting with exhibitions on a voluntary basis; (b) they learn and/or acquire new interests and attitudes by paying attention to exhibit content, noticing details, making comparisons, reading text, following instructions, etc.; (c) their cooperation in these respects depends on their expectations and the "enjoyment" that results from looking, touching, comparing, and reading, (d) they have little preparation for the subjects they will encounter, and (e) they are heterogeneous (in age, interests, attitudes, skills, knowledge, motivations, expectations, preconceptions about what they see, and the time available).

A wide variety of behavior within the museum environment can be observed (see Lakota 1975; Melton 1933, 1935; Laetsch 1985; Miles 1973). A number of visitor categories have emerged.

1: One group moves quickly, physically covering everything and seldom stopping at anything for long; the members seem to be exploring virtually as many places as possible. (They may or may not return later to something that interests them.) This group may represent a relatively low proportion of exhibit audiences, perhaps ten or fifteen per cent, but the exact proportions are not known.

2: Another group explores the museum, more or less at random, looking for things that may interest them; its members may devote considerable time and effort to exhibits with good organization and "fun" elements. This group represents the majority of visitors perhaps sixty-five per cent or more.

3: A third group are scholars, hobbyists, students, and persons who have preselected topics based on media attention or other interests and moves directly to particular areas where it devotes considerable time. Unlike other groups, most of this group has background knowledge that enables it to make effective use of the educational potentials of exhibits. It represents a small proportion (believed between three and six per cent) of exhibit audiences.

Falk (1982) has suggested a useful metaphor between department stores and museums; museum visitors are likened to shoppers where a small percentage come with the intention of purchasing something and do so, but the majority come to explore. If properly stimulated, they often buy. Shoppers spend money (and time); museum visitors spend time. Category 1 (above) may not profit from their visit no matter what is done; category 3 will spend time and profit from their visit no matter what; the majority (category 2) may or may not spend time and, like shoppers, need to be motivated to spend time in order to profit from their visit.

Some questions for research:

1. What are the actual proportions for these different groups? Do the proportions for different categories differ for museums of different sizes and types, different viewing conditions, or for the same visitors at different times?
2. Are there other visitor categories whose behavior in museums can be meaningfully differentiated from the others and potentially can affect what is learned in the museum environment?
3. What are the major expectations of the largest group of visitors: What learning or perceptual sets do they have? How do these affect what they do, see, feel, and learn?
4. Given common topics found in museums, are there common misconceptions held by one or another category of visitors; how do misconceptions affect how viewers interpret exhibit materials or what they learn? For example, groups with and without a given misinterpretation are exposed to a exhibit with the target topic imbedded in it; differences in interpretations of the topic and learning outcomes are then compared.

Area 2: The Impact of Exhibits.

Most exhibit impact research has attempted to measure cognitive learning from exhibits immediately after viewing them—usually facts, vocabulary, and low level concepts considered important by curators and reflecting the main objects and text content of the exhibits being studied. Other learning, of course, also takes place in museums that can affect visitors while there and after leaving. Exhibit impact can include many different outcomes: learning can be verbal, visual, social, or emotional; and it can involve developing an interest in a topic though not necessarily knowing much about it; a readiness to learn, new ways of looking at everyday information; sensitivity to different aspects of the world, greater confidence in one's ability to learn; new approaches to thinking and problem solving; learning to learn, and so on.

While, so far, learning has been measured mainly in terms of fairly simple levels of cognitive knowledge, exhibits potentially can impact visitors in other important ways. Different kinds of learning outcomes include the following:

- Facts, basic relationships, historical connections, vocabulary, etc.
- Concepts (learning rules that integrate different elements)
- Principles, ability to apply rules; predicting what will happen from a rule
- Ways of handling information—problem-solving skills, readiness to learn, becoming sensitized to a topic or to an issue
- Belief systems (cognitive structures which determine how experiences are translated and incorporated into existing cognitive structure; beliefs are similar to the

specific architecture built into the design of a computer which enables it to understand and apply information.

- Applications skills (ability to apply knowledge to specific problems)
- Emotions and Attitudes—excitement, readiness (resistance) to listen to (read) other points of view; self-confidence, boredom, ambivalence, hostility, self-image, changes in positive-negative attitudes for a topic or activity.

These effects can take place at the exhibit or within the museum, and/or they may occur after leaving the museum and be reflected in school and family activities, vocational choices, and so on. An exhibit experience on techtonic theory may show little effect on cognitive knowledge as measured by an objective test or a visitor's attitudes or beliefs. Yet, three months later, the visitor may choose techtonic theory for a term paper. This will lead to more knowledge and perhaps further pursuit. The final result, of course, reflects the influence of the school, class discussions, books, or friends, but the museum experience could have been paramount in setting the chain in motion.

While it is generally assumed that exhibit experiences may have any or all of these effects, little serious effort has been made to develop methodologies and assessment formats for identifying the more generalized of these effects and, consequently, there is little known about them. However, it seems likely that whatever these effects may be, they will depend largely on the design of the exhibit and its interface with the visitor. Therefore, investigations of the effects of exhibits on concept formation, attitude change, science as a process, problem solving, and learning to think must employ good instructional and behavioral design theory. While it would be interesting to know how existing types of exhibits (dioramas, computerized exhibits, traditional panels) affect visitor attitudes toward science, etc., it may be more productive to assume these effects can be produced and focus investigation on different or more efficient ways of achieving them.

Area 3: Attraction and Attention

Two primary characteristics of visitor behavior in museum environments are *attraction* to exhibits or their components and *holding power* (attention). The former is measured essentially by counting operations (how many visitors stop and look) and the second by time spent looking or attending. Both are important prerequisites to learning anything from exhibits.

Nonverbal Components. Observations of visitor behavior suggest that the nonverbal *visual* and *sensory* features of exhibits (photos, drawings, objects, life sized figures and scenes, motion, sounds, novelty) are more likely to initiate attraction than verbal elements and serve as reinforcers for holding time (Shettel et al. 1973; Peart 1984). Since attraction is prerequisite to looking and learning, it is important to know the exhibit features which have dependable attraction (stopping) power. When an exhibit topic may be considered uninteresting or unworthy of attention until more is known about it, attraction may be the only basis for getting visitor attention in the first place. Designers have good practical knowledge about factors likely to attract (lights, movement, sound, full scale size, realism, color, etc.), but, the specific relationships have not been identified under controlled conditions. Novelty or elements of uncertainty may be fundamental for attraction and holding time (Falk et al. 1978). Screven and Curzon found that "novelty" was the only factor that correlated with attraction and holding among forty-seven different exhibits (e.g., attention to crystals declined as a function of the number of crystals viewed). There is a large body of literature suggesting novelty as a major factor in exploratory behavior in animals (O'Keef and Nadel 1978).

Systematic research is needed to establish the relative importance of different types of stimuli found within exhibit environments that act as dependable attractors and reinforcers for sustaining attention. These include the effectiveness of such features as two versus three-dimensional objects; photos versus real objects; originals versus copies; live versus inanimate; motion versus stationary; complexity; novelty; and size. Is there an optimal degree of complexity, novelty, size? Under what conditions does familiarity play a role?

Verbal Components (Attraction to Text): The reading of text can be critical to understanding the visual information on display. But, the greater attraction of nonverbal sensory elements competes with the reading of text. Ways of increasing the attraction power of text need to be investigated; for example, identifying the most effective text formats, the use of questions in text, etc..

Some text formats probably are better than others for getting viewers to begin reading; e.g., text with two columns, question headings, imbedded graphics, size and clarity of fonts; short paragraphs, few words, and simple sentences and vocabulary. Little is known here, especially for museum "readers" who are standing up, on the move, voluntary, and uncued. Much is said about the length of text but there is little if any systematic data on this important question. While length appears to discourage attention, sometimes lengthy text is avidly read. Viewers often complain that exhibits do not have enough text. Will viewers read more of a lengthy text if it is broken into short paragraphs, if subsequent parts are "hidden" from view, or if shorter segments are interspersed with things for the viewer to *do*? ("Compare this design with Bottle X?" "Find two examples of this principle among these ten paintings")?

These characteristics and others may significantly affect the chances of a viewer starting to read text, although they may have little effect on holding power (which may depend more on readability and content than on format).

Questions. Questions are being used increasingly to

attract attention to text and encourage reading. Methods include the use of flip-question panels (interactive text) and cueing text content and headings to the visitor questions that are commonly generated by the visual/sensory content of exhibits.

Flip-question panels are discussed in more detail elsewhere (Screven 1986). I have found flip questions and panels quite effective. Yet, there effectiveness depends on considerable formative testing of their physical and textual design to match each exhibit's application. It is not clear how or why questions work when they do. In view of their effectiveness in attracting viewers to text in some applications, a better understanding of the variables involved would provide better opportunities for extending their usage. Manipulability, the nature of the questions used, their specificity to exhibit content, clarity, easy accessibility to necessary information in the exhibit, and the use of curiosity, challenge, and fantasy seem to play a role in visitor attraction and usage of flip systems.

Exhibit-generated questions are one class of viewer responses to exhibits and can form one basis for motivating viewer attention to text. Little is known about the relationship between the visual aspects of exhibits and the questions which these may generate in viewers, only that objects and other visual-sensory elements in displays can generate specific questions about them and temporarily motivate viewers to seek "answers" in exhibit text that pertain to these questions. In recent pilot work, my students and I probed noncued visitors for questions after viewing exhibits. We reported predictable classes of questions across a variety of exhibits containing prominent objects and photos (e.g., What is it worth? How was it made? Where did it come from? Why is it here? Why is it important? Who is the _____ in the photo? What is _____ doing?). Observations suggested that visual content elicits these questions and subsequently generates interest in text, not vice versa. It is assumed that, once this interest is obtained, text can then develop more important information about the objects. Preliminary evidence indicates that visitors also can be motivated to pursue questions not in visitor repertoires when they contain elements of fantasy, humor, challenge, and surprise (Why is a hyena's laugh music to a lion's ears? Using information in the yellow label, which painting is eighteenth century?). More efficient application of questioning methods for encouraging attraction to, and usage of, explanatory text would be possible if more was understood about them. Some published materials are available (e.g., Gilbert 1969; Graesser 1984; Rothkopf 1970), but current evidence appears not to be clearly applicable to public exhibits.

There are other research questions implied by the current uses of questions to attract, hold, and communicate to unguided visitors (see Screven 1984 for a review of some of the applications). Most of these need more systematic empirical investigation and more foundation with research and theory on question design and application in education and cognitive psychology. For more detail on the broader research and theoretical issues in using questions to teach, the reader is referred to Anderson and Biddle 1975; Andre 1979; Gilbert 1969; Graesser and Black 1984; and Rothkopf 1970.

Area 4: Orientation, Advance Organizers.

There is extensive animal research on the role of orientation in spatial settings (Kaplan 1973; Ittelson 1973; among others). Visitor orientation in museums can be *physical* (where one is, how to get someplace, where things are physically) and take the form of simplified maps, guides, arrows, color coded paths, printed instructions, films, and physical models. Visitors often ignore these or use them ineffectively.

A second type of orientation is *conceptual* (how a topic is organized, what to notice, what one will learn or be able to do, what is most important, why it is important, how it relates to other topics and may take the form of summary statements, outlines, question headlines, overviews, self-administered pretests, films, and even self-contained interactive exhibits. (See Griggs, 1983.)

Ausubel (1960) introduced the term "advanced organizer" to refer to cognitive frameworks which conceptually structure a topic beforehand. While in educational text design, the role of advance organizers is still controversial (Barnes and Clawson 1975), there is growing support that what visitors experience *before* museum visits (or before reaching subsequent exhibit areas) affects visitor expectations and perceptual and learning sets which influence the quality and quantity of learning during visits (Gennaro 1981). Taking pretests over an exhibit's topic prior to seeing an exhibit increases post-visit test scores over control groups (Screven 1974) and helps learners to more easily process exhibit information. But, if advance organizers facilitate learning, it is not clear how to obtain the necessary attention within unguided exhibit environments. Visitors often prefer the specifics of exhibits rather than first giving time to advance organizers unless these contain interactive or other fun elements. Nevertheless, visitor expectations, perceptual and cognitive sets, and a sense of the larger structure of what they are looking at appear to play an important part in how visitors will behave at, and what they will understand about, exhibits. If so, it is important to know much more about how such conceptual orientation works and how it can be effectively applied for unguided visitors.

Areas for investigation include the systematic study of the effects on learning of different types of orientation formats (summary statements, leading questions, pretests, outlines), ways of motivating attention and usage of orientation devices, and individual differences in usage of orientation information. It is possible, for example, that for some visitors, topic organization and conceptual structure must be developed in steps, with participatory ele-

ments to hold attention until the desired "overview" is obtained. Also, what is the possible role of *postorganizers* placed at exhibit exits, and what form should they take?

In conclusion, I should point out that there still is the more general question of the limits of the museum environment as a place for education. It seems likely that potentially the museum provides great opportunities for some kinds of learning for some kinds of people who have been prepared to use it productively. But, it also seems likely that it is not as good a place for other kinds of learning—e.g., for obtaining the kind of practice with the finer grain aspects of topics, for the mastery of specific information and skills, and so on. This too needs to be addressed. What are the museum's limitations as a learning environment? Such information will help museums to focus on those educational goals that are best suited for public environments.

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vidual's life. It may be identifiable and quantifiable, but it is certainly not totally dissectable. For most visitors, the time spent in the museum is but two hours of activity, out of a day filled with activities, in a week filled with activities, in a year of activities, in a lifetime of activities. That the visitor remembers anything from those two hours is what is amazing; that most visitors can not remember the myriad of facts and details they encounter is to be expected. Researchers need to understand why visitors come to museums, and how visitors use the information they glean in their future lives. Specifically what visitors do or do not do/remember, during their visits is of relatively minor importance. Needless to say, visitor behavior is hard enough to study *within* the museum, let alone months, years, and miles away from it. The importance however, justifies the effort.

The question of future directions in museum visitor research is a timely and an important one. These papers are but the beginning of a discussion that has been a long time in coming.

—John H. Falk, Lynn D. Dierking

A Proposed Framework for Exploring Museum Education Research

by John J. Koran, Jr. and Mary Lou Koran

Introduction

Researchers who have studied museums and other free choice learning settings recognize and have documented the environmental problems with doing research in these contexts (Screven 1974). In general, experimental studies are frequently criticized for altering the normal patterns of both visitor behavior and exhibit presentation. Naturalistic research and/or evaluation, no matter how unobtrusive, usually involves some types of intervention that may also influence normal patterns of visitor behavior. While recognizing these constraints, other researchers have produced extensive reviews of museum research (Koran and Dierking-Shafer 1982; Lucas 1983; Koran et al. 1983; Falk et al. 1985) indicating that significant progress has been made and that generalizations are emerging that address the following questions: 1) Who visits museums, why do they visit, and what do they do there? 2) How should exhibits be designed and sequenced? 3) What is the relevance of visitor background knowledge and experience? and, 4) How can exhibits be augmented to facilitate visitor attention, processing, and recall of exhibited material?

Most of the current research assumes that a major objective visitors have when visiting a museum is to learn something. However, it is becoming abundantly clear that a large percentage of visitors are there to "kill time," to be entertained, to satisfy curiosity, or to "people watch." Since considerable progress has been made in museum education research, despite the methodological constraints, it is likely that future research will continue to utilize more sophisticated variations on the methods that have already been used. Methodologies described by Falk et al. (1985), Dierking et al. (1984) and Peart (1984) exemplify these trends.

What appears to be missing in museum education research is an organizing framework for investigating the major variables involved. Such a framework would facilitate the creation of a systematic body of findings which could be used by museum researchers to organize and guide future inquiry in this area. It would also facilitate the integration of research results with the larger body of psychological and instructional research literature from which museum research was originally generated and upon which it will undoubtedly continue to draw. This paper will focus on identifying a framework adopted from Jenkins (1979), Brown (1979), and Bransford (1979) for exploring important variables in future museum education research and for identifying some promising areas of investigation in each of the categories identified (figure 1). The visitor is represented by the "O" in the middle. Utilizing this framework, these variables can be divided into four classes: 1) Variables relating to Characteristics of Visitors; 2) Variables relating to Visitor Processing Activities; 3) Variables relating to Characteristics of Exhibits; and, 4) Variables relating to Desired Outcomes. Any question about museum learning involves simultaneous consideration of all four of these variables. Take, for example, the question of why a visitor fails to achieve the desired outcomes following exposure to an exhibit. This could occur because the visitor lacked relevant prerequisite knowledge or abilities; thus failure is a function of the relationship between the characteristics of the visitor and the characteristics of the exhibit. Failure could also occur due to the visitor not knowing how to approach a particular learning task in an efficient manner; in which case, the failure would be a function of the relationship between visitor processing activities and the characteristics of the exhibit. Or we might find that the characteristics of an exhibit are effective for producing one type of outcome, but not for another, in which case failure would be due to the relationship between the characteristics of the exhibit

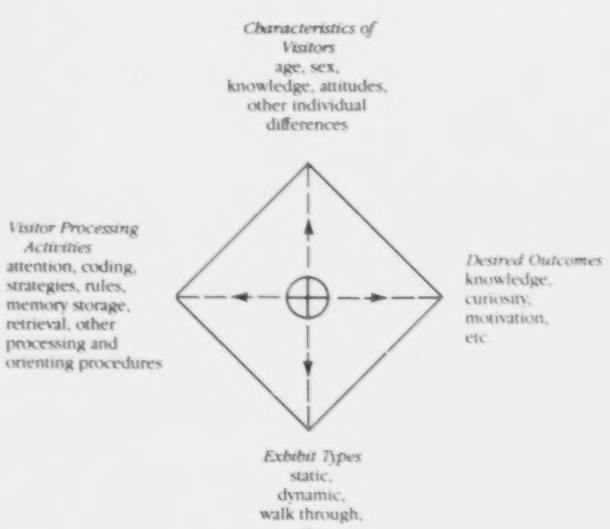
Characteristics of Visitors
age, sex, knowledge, attitudes, other individual differences
Visitor Processing Activities
attention, coding, strategies, rules, memory storage, retrieval, other processing and orienting procedures
Desired Outcomes
knowledge, curiosity, motivation, etc.
Exhibit Types
static, dynamic, walk through, etc.

Figure 1

and the desired outcome. Thus, the framework is a simple figure, but represents a complex set of relationships.

Characteristics of Visitors

Individual differences among visitors to a museum constitute an important class of variables that can and should be explored in museum research. These differences could be any characteristic of the individual's cognitive, affective, psychomotor, or developmental state which functions selectively with respect to a visitor's reaction to an exhibit. Some could facilitate learning, interest, or motivation while others could interfere with the effectiveness of a given exhibit (Koran and Koran 1984). Clearly, such differences may be expected to interact with the type of exhibit one confronts, the way one will attend to an exhibit, and the potential outcomes derived from this experience (see dotted lines in figure 1).

Some characteristics such as age and sex are clearly related to the manner in which visitors react to hands-on exhibits or case exhibits (Koran and Longino 1985). In addition, considerable research in psychology (Cronbach and Snow 1977; Koran and Koran 1984), and museology (Shettel 1968), suggest that other learner characteristics appear relevant for research in museums in the future. Cronbach and Snow (1977) suggest general ability as the learner characteristic which most frequently enters into instructional interactions. Since the type of exhibit and orientation a visitor is exposed to, be it static, dynamic, or walk through (c.f. Koran et al. 1983), may differ in the information processing burdens it places on, or removes from the visitor, one would expect the regression slopes of outcomes on general ability to become steeper or shallower accordingly. It appears, from studies in contexts other than museums, that the more learners are required to puzzle things out for themselves, to organize their own activities and construct their own meanings, the more "high ability" learners may be able to capitalize on their strengths. This line of inquiry, if generalized to the museum setting, would suggest that exhibits that are designed to relieve learners from difficult reading, from having to analyze complex concepts and build their own cognitive structures, or exhibits based on concrete information might compensate for the weaknesses of less able visitors, perhaps the museum's average visitor. Thus, the more an exhibit assists in required information processing through the use of arrows, questions, bold print, or recessing, the better that exhibit might be for the average visitor or visitors with limited background in the area. Conversely, the more of the required information processing which is left to the learner, the better an exhibit of this type might be for high ability or well-informed visitors in the field the museum specializes in. Shettle's (1974) study seems to confirm this. His findings indicated that visitors with highly developed science skills performed best when confronted with science exhibits requiring those skills. Certainly, if this group of findings were tested in other museum settings and found to hold true they would have a major influence on exhibit and museum design, patterns of visitor movement through the museum and the design of written orientation materials for visitors with different characteristics.

Future research should consider knowledge of visitor entering characteristics; different kinds of orienting or processing directions to fit different types of learners; exhibits which could be varied to provide the same experience using different arrangements of artifacts, color, labels, etc.; and desired outcomes, specified in advance. Those who have done research in museums recognize the difficulty of controlling these conditions. It is possible that the use of simulation could deal with this control issue (e.g. Koran 1974; Dierking et al. 1984).

Characteristics of Exhibits

Danilov (1984) describes a major trend in natural history and science and technology museums—the tendency toward visitor involvement, with an effort "to make science interesting and understandable to young children" as well as adults. The goals and objectives of the various museums described in this article were much alike, and quite laudable, and suggest yet another direction in future museum education research: accountability. In general, visitor cognitive, affective, and psychomotor enhancement from exposure to hands-on exhibits, as well as standard case exhibits and walk-through exhibits, is poorly evaluated, documented, and reported. When money is used from private and public foundations for the development of various free-choice environments, both the foundation and the museum should insist on rigorous evaluation procedures. Future museum research will undoubtedly need to address this issue in a way similar to the Peart (1984) study. The process is tedious, but the model in figure 1 delineates the territory clearly. For whom (visitor characteristics), under what kinds of conditions (exhibit characteristics), with what types of learner activities and for what desired outcomes are these exhibits most effective? Questionnaire data is notoriously unreliable! Videotapes of behavior, random observation, and self-report provide poor accountability data. As museum educators become more and more familiar with the variety of ways reliable and valid data can be collected, we anticipate an improvement in exhibit and museum evaluation and accountability.

When exhibits already exist, the evaluation questions might include: 1) Do the exhibits achieve the outcomes set for them? 2) Can they be altered to assist visitors' processing and orienting procedures, to achieve a wider variety of outcomes or to take into account the differences among visitors? The four categories delineated in figure 1 and data derived from them could guide the designer of new exhibits: 1) For whom is the exhibit designed? (Characteristics of Visitors) 2) What kinds of outcomes seem most appropriate for this group? 3) What kind of exhibit would appear to be most likely to achieve these

outcomes? 4) What orienting or processing directions could be incorporated to facilitate visitor achievement of desired outcomes? Again, all four areas of the figure 1 model interact and both the researcher and practitioner can use them as a guide for generating research and categorizing and utilizing research findings during both exhibit design and evaluation.

Visitor Processing Activities

Visitors may engage in a wide variety of activities or processes when viewing an exhibit. For example, the visitor may try to remember details, predict outcomes, note confusions, incorporate the informational content into prior knowledge possessed, or seek relationships or analogies to prior knowledge, depending on the orienting or processing instructions provided by the museum exhibit, and/or the particular desired outcomes.

Since most museums neither have the money nor the manpower to extensively develop new exhibits, a first step in future research might be to focus attention on how to vary orienting or processing directions for visitors in order to permit the same exhibit to be used for visitors with a wide variety of characteristics, attempting to achieve a wide diversity of outcomes.

Given an exhibit which could be considered a stimulus, visitor processing involves paying attention to the exhibit, perceiving the exhibit using all available and appropriate senses, coding or internally converting the stimulus for short- or long-term memory and retrieval. Adjuncts such as providing information panels prior to and following a large exhibit, such as a walk-through Florida limestone cave, might provide the same internal processing effect as a pre-museum visit discussion or lecture for school students. Variables that might include providing problem sheets prior to an exhibit, varying docent introduction or cueing verbal behavior prior to, or during, an exhibit visit need further exploration using procedures such as those described by Gennaro (1981). Although the research on processing has so far focused primarily on attentional adjuncts (Screven 1974; Gennaro 1981; Koran et al. 1983; Koran et al. 1984; Koran et al. 1985), future research should expand beyond this to investigate the relationship of attention to coding, memory, and retrieval. With three basic types of exhibits (static, dynamic, walk-through) and a variety of potential, desirable outcomes (cognitive, affective, psychomotor) and visitor characteristics, research questions in this area are numerous and findings could be both heuristic and valuable to the practicing museologist.

For instance, Brown et al. (1981) in her discussion of research on learning from texts and the effects of training students to learn from them, makes some interesting observations which could be tested in the museum setting. In the research reviewed, subjects were trained to process the type of information they would encounter in the instructional treatments much as one would design modules in a museum setting to train visitors in how to process and remember elements of particular exhibits. One simple training task consisted of presenting students with a list of pictures, too long for them to recall without using some deliberate memory strategy. They were told to study the lists for as long as they wished, but recall was low. The training they subsequently received provided strategies which could be used to facilitate recall including a self-teaching component, and feedback allowing students to monitor their state of learning. Two effective strategies were found to be cumulative rehearsal and anticipation. These activities acted as an aid to memory and provided information about the current status of their memory if anticipation of the next picture was low. Findings were encouraging for older students with retention lasting up to a year. Brown's findings on developing study behavior for training to learn also appear to have some implications for replication in the museum. She recommended a) simplifying tasks so that basic rules can be demonstrated; and b) teaching an appropriate learning strategy and training the self-monitoring of that strategy. If these findings were found to be generalizable to the museum setting, they could be employed in a wide variety of traveling museum exhibit cases for school students and in permanent exhibit design. Certainly, casual observation and emerging data (Koran et al. 1984; Koran et al. 1985a; Koran et al. 1985b) suggest that visitors to museums need all the help we can provide them in learning what to attend to, how to attend to it, and how to approach the task, process the relevant information and retain it. The aforementioned research described by Brown et al. (1981) has focused on relatively low levels of content. Most exhibits, once beyond the taxonomic level, move to conceptual, principle, and process knowledge placing major demands on the visitor to be equipped to cope with these. If Brown's results are found to be generalizable to higher levels of content this line of inquiry, applied to the museum setting, would be a fruitful one to explore in the future.

Outcomes

Earlier it was asserted that learning was a commonly expected outcome of museum visits. Certainly, this is true for many school visits and for adults whose background directs them to a certain type of museum to accommodate their interest, such as a university museum. However, other outcomes which can be measured also seem to be worthwhile. For example, curiosity, psychomotor development, interest, appreciation, motivation and generalization all could be considered among the desired outcomes of a museum visit. Future museum research will undoubtedly continue to be concerned with the wide range of outcomes alluded to by considerations of differences in visitor characteristics and ways visitors process information and might profitably be guided by a model proposed and used by Koran and Koran (1983).

Curiosity is the major outcome considered here, al-

though the full spectrum of outcomes may be incorporated. It is possible, while exploring curiosity, to note such psychomotor behaviors as movement toward objects, manipulation of objects, ordering objects, and time on task. In addition, verbalizing about objects provides an indication of the degree of curiosity present, as well as the extent of meaningful processing taking place. Koran and Longino (1982) describe in detail ways to produce a curiosity response and ways to measure whether or not a curiosity response has occurred. It is relevant to both the exhibit domain and the outcomes domain of figure 1 to consider such questions in the future as: 1) If children in certain exhibit contexts are curious will they learn more? 2) Are certain exhibits more or less effective in producing certain kinds of outcomes, e.g. recall, generalization, curiosity? 3) Do certain exhibit characteristics facilitate processing activities leading to certain types of outcomes better than others? and 4) Are certain kinds of exhibits more or less appropriate for certain kinds of content (levels of content such as conceptual, process, problem solving) and for certain types of visitors?

In an article dealing with the role of attention on children's learning of science concepts (Koran and Lehman 1981), it was emphasized that focusing children's attention on the relevant aspects of objects and events used to teach concepts was critical to concept formation. Adjuncts such as those categorized in figure 1—verbal directions, arrows, teacher pointing and written or oral questions—all functioned to direct children's attention, thus promoting selected outcomes. Color was found to aid in directing attention for younger children and shapes tended to be more compelling for older children. Another factor described as critical to the outcome of concept formation was the amount of time a learner spent observing and manipulating objects or events that contributed to defining concepts. Attention and time on task are essential, but in addition, curiosity was probably a driving force, that is to say, more curious children spent more time with novel examples than less curious children.

This type of research, if replicated in the museum setting, would provide museologists with insights regarding not only outcomes other than learning, but also suitable adjuncts to an exhibit which might enhance the achievement of these outcomes. For example, outcomes such as the development of curiosity could direct research in museums to the relation of structure in museum exhibits to curiosity development; the role of docent modeling as well as modeling of parents, peers and perceived specialists (Koran et al. 1985) to curiosity; the relationship of questions in museum exhibits or questions posed by docents to curiosity development, the relationship of reinforcement variables to curiosity; and finally, the relationship of age, sex, and race to curiosity.

Curiosity development has been selected as one outcome that should be explored in future museum research as an illustration of the interaction of exhibit type, visitor characteristics, visitor processing, and potential research outcomes. Most of the research questions posed with regard to curiosity could also be applied to a wide variety of other outcomes. Modeling, a processing mediator, for instance, is a powerful way to introduce behavioral outcomes. Many first time visitors to a museum will not know how to act when they approach different kinds of exhibits. The effects of videotape recordings or live models demonstrating appropriate behavior should be explored in different exhibit contexts and with different types of people and curiosity in mind. Similarly, the effects of docents can become the subject of research studies. Research involving docent questioning behavior such as levels of questions, frequency of questions and types of reinforcement to visitor questions can and should be explored in assessing a variety of outcome measures. In each of the above examples, the type of outcome is important and varies in levels, types of content, the nature of the exhibit, and the characteristics of the intended audience. Each may be expected to interact with desired outcomes.

Already interactive computer video tape and disk systems are being utilized as exhibit adjuncts or as exhibits in their own right. The introduction of this technology provides an opportunity to systematically study its impact. These systems should be introduced and evaluated in terms of the outcomes they are designed to produce, the visitors they will influence, the exhibits they are most compatible with and the amount and kind of processing they influence. The future research potential in this one area is staggering.

Conclusions

Museum education research in our view is an applied interdisciplinary field relying on research and methodology derived from psychology, education, sociology, anthropology, and other areas. This paper has illustrated the interaction of four classes of variables. The role of museum educators is complex and difficult. But if we keep in mind the interactive nature of learning illustrated by the framework presented in figure 1, some important insights into how we might facilitate visitors achieving desired outcomes emerge.

We have presented some ideas regarding the future direction of research and development in museums, utilizing the four categories of variables delineated, as a guide for interpretation, application and future research and design in museums. We recognize that in many cases our generalizations went beyond the data given and were frequently from research domains widely disparate from the museum. We concede that the wide variety of museums with varying content and artifacts makes generalizing difficult. However, until a model is utilized which has the potential to guide the investigation of important variables in each of the categories designated and to relate findings to a larger body of psychological and instructional literature, reviewers of research will, by necessity, construct their own context and meaning and both researchers and

practitioners will have difficulty applying research findings. Furthermore, research will continued to take place in a more or less haphazard manner. Considering the interaction of visitor characteristics, exhibit type, visitor processing, and desired outcomes provides a framework for a solid theoretical basis for future research and development in museums.

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From The Chair

Report from the Board

The MER Board of Directors began the 1985/1986 season with several changes in its membership. Three members left the Board this year: Suzanne Derby, who acted as the Board's liaison with the *Journal* Editorial Committee; Emily Eig, who served as Treasurer for four years; and Lee Oestriecher, who was responsible for Board elections for the past two years.

Five seats on the Board were open for election in the fall. Newly elected Board members are: Salvatore Cilella, Development Officer at the Smithsonian; Tracy Gillespe, Administration Assistant and Education Director at Loudoun Museum, Leesburg, Virginia; and Michael Judd, a graduate of the MAT in Museum Education Program, George Washington University. Caryl Marsh and I were reelected.

At its first meeting of the new season, the Board elected the following as officers: Gretchen Jennings, Chairperson; A.T. Stephens, Treasurer; Nancy McCoy, Recording and Corresponding Secretary; Linda Currie, Membership Secretary. In addition to the above mentioned members, Ken Turino, Louise Steel, and Bonnie Van Dorn complete the Board.

During the past year the Board has focused on two distinct but related issues: 1) an examination of the current and future role of the Museum Education Roundtable and 2) A marketing and development effort to expand both publication sales and membership. We plan to continue to work on both of these areas in the coming year.

The first step in the examination of the role of MEF was to review and amend the by-laws, which had not been revised in some ten years. This was completed in October 1985. These by-laws will be submitted to the membership for ratification. The second step was the appointment of a task force, consisting of Joan Madden, Caryl Marsh, Nancy McCoy, Julie Shepherd and Ken Yellis. The chairperson is Suzanne Schell. This committee will make its recommendations to the Board by June 1986.

Our marketing and development efforts have resulted in a ten per cent increase in circulation of the *Journal* and a twenty-five per cent increase in MER membership over last year. In addition, sales of back issues of the *Journal* have been brisk.

At a time when there is increased attention to the role of education in museums, the Board hopes that MER, through its programs and publications, can provide leadership in examining and articulating significant issues in the field.

—Gretchen Jennings

The Missing Link: A Look at The Role of Orientation in Enriching The Museum Experience

by Robert L. Wolf, Ph.D.

There is no simple way to describe the museum experience. My research efforts and those of others, continuously underscore the fact that individual visitors perceive their experience in museums in uniquely different ways. Perhaps the most useful insight concerns the *engagement* between the visitor and the museum and how such engagement affects the quality of a person's experience. These engagements or interactions can be extremely varied but are always influenced by not only what the museum provides in the way of objects, context, and information, but also by what each visitor brings to the encounter in the way of personal interest, previous experience, frame of reference, and individual learning style.

Unpacking the Museum Experience

Some visitors have an enriched experience in a museum because they spend more time in a particular exhibition for one reason or another, i.e., location, aesthetic appeal, hands-on opportunities, etc. Others have meaningful experiences because certain objects appeal to their personal interest or because their interest is sparked by a label or film or interpretative event. Some visitors even come to the museum to learn something specific. Visitors engaged in learning activities ask questions, read labels, and even transfer information from one area to the next, thus enhancing their own enrichment as they move along in their experience.

The degree of engagement which results in favorable impact and increased learning is not the result of one single factor, nor is it easy to identify even a set of factors that contributes to the value of someone's museum experience. Ultimately what matters is how the visitor *uses* the environment—the information, the objects, the interpretations—to enrich his/her own existence.

There has been an inordinate amount of discussion of late as to how visitors learn in museums. Why we even ask this question befuddles me. As a cognitive psychologist, I am convinced that people learn in museums in much the same way as they learn in other environments. Of course, museums might offer different opportunities for learning—through objects, labels, mediated presentations, interactions with other persons (visitors or museum staff), and the like, but beyond tactile, audio, visual, spatial, interactive, and verbal there really are not all that many unique modes of presentation that visitors cannot experience elsewhere. This should not suggest that museums are like other learning environments, for indeed they are special. But they are more special for what they *contain* rather than how they *teach*.

To repeat, the key in any meaningful learning experience is engagement. What *is* unique about museums is that they have great potential to engage visitors in perceiving, questioning, comparing, and hypothesizing about their own experience in relationship to interesting objects, artifacts, and works of art, as well as representations of culture, history, natural history, science, and technology through the medium of the past, present, and future.

In a word, museums should be viewed more as places that can enrich visitors' lives—culturally, aesthetically, and interpersonally, rather than as teaching institutions that can impart specific pre-defined content or knowledge. Rather than worry about how people learn—which represents only one aspect of their potential enrich-

ment—museums should be devising ways to provoke, challenge, stimulate, energize, question, and absorb visitors in a life-enhancing opportunity. What people gain in information units is not nearly as important as what they gain emotionally—how connected they become to the object, the exhibit, or its interpretation.

The element that has been missing most in achieving that connection has been the kind of orientation visitors need to maximize their chances for self enrichment. Museum professionals have been experimenting with every teaching fad and gimmick that has been developed by the educational research community but in the process have made little significant progress in creating a constituency who possess "museum literacy" so that they can capitalize on being in the museum environment.

Museum literacy is just another way of describing museum orientation—that mechanism or support that visitors need in order to successfully process their (logistical and conceptual) experience. While many museums have developed effective logistical orientation strategies, few have helped visitors become literate on how to use the museum as a life-enriching opportunity. In providing visitors with orientation help, there are a number of psychological and pedagogical principles that should be kept in mind.

Psychological Orientation Principles*

In a psychological sense, the term orientation represents a perceptual task involved in the processing of information to determine a course of action for coping with conventional demands. In a museum setting visitors almost immediately attempt to orient themselves, even if that orientation behavior occurs on a subconscious level. The human tendency is to seek out sources of information that help make people comfortable with where they are and what they need to do. Such sources of information might include architectural cues, graphic-print material, and direct contact with either human beings or some kind of self-initiated mediated format. From this array of available information museum visitors will try to find out where they are and begin to choose the next course of action.

In breaking the concept of orientation down to more specific terms, it is useful to consider a person's general response to the environment, how he/she creates mental images or maps about the environment's different properties, and what decision-making processes are needed. The key in planning a museum environment is to provide the kinds and levels of stimuli necessary for visitors to adequately perform their critical perceptual tasks; namely, locating themselves and deciding their next step(s). This kind of perceptual maintenance should be the primary goal of any orientation effort. If this perceptual maintenance is not achieved, disorientation occurs and with it comes fatigue, loss of enjoyment in using the environment, frustration, irritability, and even panic. But, most important, disorientation compromises the ultimate potential for quality experiences in the museum.

In attempting to avoid disorientation, museum professionals must be cognizant of certain psychological constructs that directly influence orientation behavior. Constructs such as concentration, arousal, information overload and stress and social dynamics will each be briefly discussed below:

A. *Concentration*

All persons have certain innate abilities to concentrate on tasks that have value to them. Additionally, cognitive skills required for more intense kinds of concentration activities can be learned and mastered. These latter skills are mostly employed during formal or structured activities where a person is aware of the importance of his/her concentration ability. Distractions such as unnecessary or unwarranted noise can often disrupt even the most serious effort at concentration. Thus, distraction must be minimized in any orientation situation because of its potential to dislodge concentration and take attention away from the necessary tasks. On the other hand, concentration can be enhanced by any orientation aid that helps people attend to useful environmental stimuli. But for any aid to be useful, it must arouse a certain degree of interest or excitement in the visitor.

B. *Arousal*

Levels of tension or excitement that human beings experience have a direct effect on their ability to effectively process environmental information. Psychologists refer to this sense of excitement as arousal, and it is applied to both emotional excitement and an increase in brain activity. States of arousal range from a low level near sleep or unconsciousness, often characterized by feelings of boredom, to highly excited feelings that could be associated with panic behavior. In general, very low (boring) or very high (panic) states of arousal are less pleasant to experience than are moderate levels. From the standpoint of orientation needs, what is most significant about psychological arousal is that information is processed most effectively at moderate or middle range levels. If arousal is very high or very low, a person's attention to environmental cues is apt to be impaired. Orientation strategies should evoke these middle ranges using some complexity or novelty in their design and by avoiding schemes that are ambiguous, overly complicated, or provide *too* much information.

C. *Information Overload and Stress*

Many museum environments notably provide more stimulation than most people can comfortably process or organize. This information overload can cause high levels of arousal, and thus constitute a form of environmental stress. In a museum, a visitor's reaction to such overload is to channel or focus one's attention more narrowly, thus tuning out peripheral stimuli. Too many labels arranged in an incoherent fashion may be less instructive than too

*The discussion on Psychological Orientation Principles is derived from the work of Ross Loomis, Colorado State University.

few, since visitors may totally ignore information that is presented in a crowded manner.

By the same token, settings may have insufficient stimulation or "information underload," resulting in low arousal, boredom, and fatigue. Such monotonous settings can also be stressful, and lowered levels of attention can make orientation cues less effective. Providing the right amount of information, on the other hand, and arranging it in a compelling but not overly demanding way will positively influence an orientation activity. Of course, information can be presented through social interaction and this latter strategy can also control for information overload.

D. *Social Dynamics*

It is certainly no surprise that people serve as sources of orientation information and such socially-based information can be direct or indirect.

In direct interaction, visitors might ask available museum staff for orientation help. Simply having staff present, however, does not necessarily guarantee that they will be used effectively. Some people will never initiate human contact with strangers or official personnel because they possess introverted personality characteristics—this is true in spite of their apparent disorientation. The key in providing direct social interaction as a way of facilitating orientation is to assist persons in overcoming their apprehension to seek help.

In addition to direct forms of human contact, it is also true that most persons will follow others that appear to know what they are doing. The close proximity of other visitors in a museum environment can serve as a guide to movement behavior. One way visitors can handle their orientation decisions is to follow the lead of other persons. Crowding, however, can be a source of disorientation. Other visitors can create distracting stimuli that continually evoke visitor attention and, thus, leads to information overload. In capitalizing on crowd behavior, orientation spaces should be created in such a way that the movement of visitors is dictated by the environmental design. In this manner, orientation aids can be built upon the social dynamics that visitors tend to display in public access spaces.

Pedagogical Orientation Principles

Over the past twenty years research on cognition and learning has shed significant light on how people acquire knowledge in non-formal educational settings. More recently, insights from this research have been applied to the kinds of spontaneous learning that takes place in museums. In the context of visitor orientation such insight can help create mechanisms and formats that facilitate the orientation process. Specifically, concepts such as cognitive difference, multiple teaching opportunity, reinforcement theory, and conceptual focus contribute to the enrichment of the museum experience.

A. *Cognitive Difference*

Simply stated, it is a well substantiated fact that individual people learn and think differently. These differences relate to being attracted to different objects or different types of information. And, once attracted, persons will employ different strategies in interacting with and processing the information about the stimulus in question. Because individuals possess different ways of thinking, they will put information together differently and use different interpretive modes. They will engage in different learning tasks by employing a variety of information processing techniques. The most critical aspect of understanding the importance of different thinking strategies is to consider the range of interpretations the stimulus provokes. The design of the presentation must then merge the interpretive possibilities with the conceptual and aesthetic goals of the exhibit. Variety of formats used to present information increases the probability that a wider range of individuals will benefit from the stimulus. It must also be recognized that in addition to cognitive variation, people bring to their museum experience a multiplicity of values, perceptions, and interests. Orientation success depends upon how astutely these factors are addressed.

B. *Multiple Teaching Opportunity*

Any good teacher uses redundancy to drive salient points home. Likewise, in a museum environment important messages must be repeated in different ways to insure that the message is communicated to as large a number of persons as possible. Subtle messages tend to elude the visitor. If a major concept or point of information is to be conveyed, it must be done with clarity and succinctness. Thus, the skill in providing redundant information suggests that presentation formats and semantic constructions should vary so as to avoid boredom, and at the same time be sufficiently similar to communicate critical aspects of the desired message.

C. *Reinforcement Theory*

It has long been established that human beings will seek out experiences that are rewarding to them and at the same time avoid experiences that are distasteful or unpleasant. This kind of conditioning has been employed by psychologists and educators in shaping behavior in most impressive ways. The effective use of behavioral reinforcement depends upon how well a person knows what is expected of him/her and the kind of guidance he/she receives along the way. As stated earlier, most museum visitors want to feel they have accomplished something during their experience. They want to feel that they haven't "wasted their time" and that the trip was "worth it." If people can be helped to understand what accomplishments are possible within the context of a museum and then are given appropriate reinforcement throughout their visit, this sense of achievement can be shaped rather effectively. To provide this information to the visitor requires that museum planners clearly identify the scope of possibilities throughout the context. This analysis can dis-

play the range and types of possibilities presently available and identify gaps or absence of reinforcing experiences.

D. *Conceptual Focus*

Within the museum field the concept of orientation is typically used to describe logistical and spatial considerations. In my research, however, it has been pointed out repeatedly that visitors experience disorientation when they are unable to understand what a museum is trying to convey through its exhibitions and its information presentations. In fact, visitors are often more frustrated about this latter kind of disorientation than they are about not finding their way around the space. Visitors benefit from the kind of guidance that lets them know what is expected of them if they wish to maximize their experience. What concepts, themes, or messages are being conveyed? What sense can they make from objects, exhibits, labels, etc.? Museums can and should do a more effective job in presenting each piece of information so that it builds upon or relates to other information available. This process extends and enriches the kind of conceptual understanding that enables visitors to relate their experience to other aspects of their lives. Finally, a conceptual path must be established so that visitors have the opportunity to understand each concept in a sequential and interrelated manner. This approach by no means suggests that all presentations be linear and convergent. Nor does it suggest there is only one right way to experience the stimulus. It *does* suggest, however, that the presentation must be designed so that "room for error" is minimized. Orientation effectiveness will depend upon the ability of the museum to orchestrate spatial considerations with conceptual presentations, and do so in a manner that is systematic and integrated.

The psychological and pedagogical factors taken together underscore the conclusion: people can only reap the full educational or aesthetic benefit of a museum experience when the conceptual demands of that experience are made manifest. In this regard, museums need an area where visitors come to find out what it will take to benefit from the time they have available for their visit. In this way, conceptual insight can be conveyed about what their options are, and then help can be provided as to how those options can be successfully achieved. Renewed thinking and creativity in the design of orientation areas is necessary to teach the public museum literacy; to assist visitors in their enjoyment; to bolster the impact of the museum itself. One clear challenge is to develop orientation so that visitors who rush into the museum environment will gradually be induced to consider orientation areas as a necessary beginning—for any museum context.

Framework for Orientation Design

Because the educational mission of museums is exceptionally broad, the orientation program should not attempt to do too much. Expectations about the role of orientation must be kept reasonable. It cannot help each visitor fully understand all aspects of the museum, nor can it locate every object on display. What it can do, however, is give interested visitors a better sense of the place, and for many it can at least acquaint them with a range of options that perhaps they had never before considered much less experienced.

In designing the orientation space museum professionals should keep several important considerations in mind:

- The area must be compact and straightforward. It should contain information about the function of visitor orientation, options for museum experience, and up-to-date announcements about events and exhibits;
- The area must be comfortable and inviting. It should convey that no matter how crowded the museum is, it is still a place for reflection, contemplation, and cultural or aesthetic appreciation;
- The area should be attractive and thus contain representational objects from the collections. Each major collection or exhibition should be described and clear information available as to its location;
- The area must be arranged for maximum flexibility as the orientation purpose may change to accommodate future patterns of use;
- The area must contain a variety of formats for presentation so as to account for visitor differences in perception, interest, ability, and prior experience;
- The area must provide brochures and handouts that stimulate visitor curiosity and have the potential for suggesting new opportunities for how the museum can be used;
- The area must be staffed with persons who understand the importance and value of orientation. Such persons must not only be familiar with the museum, but must also be familiar with visitor needs, interests, and concerns. The overriding approach should be proactive and staff should help open possibilities that visitors may not be aware of;
- The area must not only be designed to avoid traffic flow problems but actually to facilitate movement through the arrangement of kiosks and wall graphics that create a logical conceptual path; and finally,
- The area must provide multiple access to information as well as provide insight into questions visitors might have as they leave the museum.

Thus, the orientation component should be a center for the contemplation of the museum experience. It should help people enter that experience, and exit it as well. It should avoid overload by keeping its messages simple and clear. Objects, posters, and wall graphics should enhance the visitor's interest in a compelling manner. It must inform but not intrude. And at the very least, as visitors leave the orientation area they should have a better plan for their visit than they did before the orientation experience.

If museums further desire to present visitors with more

advanced themes or concepts in the exhibits they offer, then additional assistance must be offered in each exhibition area. The following suggestions should help visitors derive a more detailed enrichment from their experience:

- The purpose of any exhibit must be clearly stated to maximize its learning potential. Likewise, the purpose of each display area within the exhibit should also be made clear and the interrelationships between the display areas should be apparent to the average visitor.
- Each major concept requiring emphasis must be strategically positioned by an artifact, specimen, object, or display area that has sufficient appeal (dramatic and/or aesthetic) so as to attract visitor interest and attention.
- Labels that convey important conceptual information must be stated succinctly to insure that they will be read. Additionally, a smaller percentage of selected labels must present details that allow for more in-depth coverage of the messages being conveyed.
- Conceptual labels must be cross-referenced with each other throughout the exhibit to help visitors comprehend conceptual relationships.
- Highly detailed and technical information designed specifically for the exceptionally interested and/or sophisticated visitor should be presented through some kind of optional format (Plexiglass placards, handouts, etc.). In other words, some visitors must have the opportunity to seek out greater degrees of specificity at the same time most visitors are not inundated with an overwhelming amount of printed text.
- Mediated presentations within the exhibit deserve more careful consideration. On the one hand they work because they appeal to visitors' differential learning styles. For certain topics, there are clear advantages in a mediated format: scientific concepts which are dynamic in nature can be presented in a congruent format; historic or temporal progression can be conveyed within a brief time interval.
- Technical components of the exhibit should be clarified so that the average visitor can readily comprehend them. Many persons express initial interest but show increasing disinterest (or at best, passing interest) because the technical depth of the information presented has not taken into account the individual who, in a typical visit, is required to stand and read or observe for several consecutive hours on a variety of topics that may or may not have any relationship with each other. This experience is akin to reading a portion from each of twenty-six volumes of an encyclopedia while walking or standing in place for several hours.
- Illustrative examples that demonstrate conceptual relationships are critical.
- The design of the exit area should be decidedly dramatic as it leads the visitor to begin the museum experience.

Some Concluding Thoughts

The suggestions and considerations about orientation and exhibition design will assist visitors in gaining more effective and meaningful access to the vast resources of museums. This access will, in turn, help visitors take considerable advantage of the museum through exploration, participation, and personal expression. In providing visitors with extended opportunities to better grasp the magnitude of their experience, museums can communicate and instruct in a manner that facilitates intellectual, aesthetic, cultural, and educational satisfaction. Museums need to be less concerned about teaching specific facts and concentrate more on creating environments that enable individuals to gain more insight into the physical, cultural, and aesthetic world that surrounds them. Museums can help visitors most by teaching them something about the museum and about the available possibilities that will make the visit a more meaningful one. Orientation efforts cannot be halfhearted. They require as much planning, conceptualization, and evaluation as the most lush and extensive exhibit. Orientation is a vital link in developing museum literacy. Done well, it has the potential for connecting the public to the museum, and, by virtue of this connection, to the pleasurable and valuable learning experience that will ultimately transpire. Accordingly, researchers should concentrate their energies on studying the hows and whys of visitor orientation, rather than merely the whats of learning.

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Computers Everywhere—But What Happened to the Research?

by Patricia McNamara

"My own view is that the museum is a seriously underdeveloped national educational resource—that with a major research and development effort aimed at exploiting the electronic computer, we can turn our museums into highly powerful centers of popular learning that can complement our schools and that can advance significantly the nation's cultural development." (Lee, 1968, p. 367)

Nearly twenty years ago, Robert S. Lee eloquently described the "computerized museum." He saw the technology's potential to both individualize learning experi-

ences and permit learning experiences previously considered impractical or even impossible. He recognized that the museum was the ideal environment in which to experiment with this new educational tool.

Perhaps because the technology has developed so rapidly during the intervening twenty years, the museum profession has proceeded with implementation at the expense of the research that Lee advised. Today's computers are so small and inexpensive that their appeal is not surprising. Even a cursory literature review documents the profession's widespread interest. The editors of *Museum News* recently devoted an entire issue (August 1985) to a discussion of both videodisc and computer applications in exhibitions, collections management, and museum administration. *Museums For a New Century* similarly highlights computer-based projects at a number of institutions, ranging from the Erie County Historical Society Museum to Impression 5 Museum (Commissions on Museums for a New Century 1984). These publications are representative of the state of information in this area. It is fairly easy to find descriptive accounts of computer applications in museums (Mintzer 1984; Rhees 1981; Ucko 1983; Wrege 1982). Analyses of the characteristics that recommend computers to museum applications are equally numerous (Borun 1983; Coates 1984; Commission on Museums for a New Century 1984).

It is difficult, however, to locate analyses of the ways in which computers are actually used by museum visitors. The exceptions (including Borun 1979; Sharpe 1983 and Van Rennes 1978) are remarkably few, given the enthusiastic and widespread adoption of the technology by exhibition designers and museum educators. Even museum staff that have devoted considerable resources to the implementation of computer-based programs and exhibits would be hard-pressed to describe in any detail either the characteristics of visitors who make use of their computers, or the outcomes of such interactions.

Of course, this shortcoming is not unusual in light of the museum profession's general reluctance to commit its resources to the analysis of visitor behavior. But there are obviously factors at play here dictating that greater attention be paid to this particular research effort.

The dramatic and rapid technological advances of the last ten years are the harbingers of even more fundamental changes in the ways that human beings will work, play, communicate, and educate themselves. The current slump in the home computer market is temporary—over the next ten years the computer will become as commonplace in the home as a television set, although we might not recognize its future incarnations. On the office front, thirty million jobs may be computer related by the year 1990 (Goldberg 1984). The nature of the computer makes it inevitable that the educational experience of future generations will also change its locus and nature. The role that tomorrow's museums may play in this revolution is dependent to a great extent on the empirical foundation that we lay today. There are a number of contributions that museum researchers may make. Two areas seem of primary importance: the involvement of so-called "nontraditional" audiences and the appropriateness of different formats for different audiences.

Nontraditional Audiences

It has been well documented that computer skills and experience are not distributed normally throughout the population. The most well documented inequity is that linked to sex (Stone 1983), but other populations may be similarly disadvantaged (e.g., senior citizens, the poor, racial minorities, etc.). What is already known about sex-linked inequities should make the situation involving girls and women of particular interest to museum researchers.

It has been commonly observed that both girls and boys participate equally when equally exposed to classroom computer activities, and both profess equal interest in computer activities (Lockheed and Frakt 1984). Differences arise, however, when "extracurricular" use is examined—at home, in after-school computer labs, at summer computer camps, etc. The differences in participation level are often dramatic. In a review of attendance records at twenty-three summer computer camps, Miura and Hess (1983) found that the girls' enrollment was inversely proportional to cost and sophistication of the courses offered. For example, girls accounted for twenty-eight percent of the enrollment in beginning and intermediate classes, but only five percent of the enrollment in more advanced classes. Museums with computers available for public use (whether in exhibit areas or more restrictive "labs") offer very similar discretionary educational opportunities. In the absence of good data (i.e., something beyond the anecdotal), museums cannot be sure that they are actually serving their intended audience. The school-based research suggests that, in fact, museum computers may be best serving those who already have ample opportunities to use them. When a competitive situation, such as a popular computer in an exhibit, long lines in the computer lab, or expense is involved, those who ultimately spend time with the computers are most likely to be males who have already used computers, either at home, school, or work.

It is obvious that data should be accumulated on the present use of computers in museum settings, whether in formal classes, informal lab settings, or exhibit installations. In the case of classes, it is relatively easy to monitor enrollment levels of various populations. At the Science Museum of Virginia, for instance, a limited series of children's computer classes has been offered over the past year, and 115 participants have completed brief surveys concerning their prior computer experiences.

In classes marketed primarily to children in school programs for the talented and gifted, boys and girls were represented equally in the enrollments, and ninety-two percent had some prior experience with computers

(sixty-six percent had used a computer within the last month, seventy-seven percent had used a computer in school and forty-two percent had used one at home). Interesting contrasts were observed this past summer, when several changes were made in format, cost, and marketing strategies. A wider range of classes was offered, including more intensive sessions and a number at more advanced levels. Tuition was increased to cover an increase in session length. The classes were also marketed to a much wider audience. Males were disproportionately represented in these summer classes (they accounted for sixty-two percent of the enrollment). Moreover, the girls enrolled in the summer classes were more likely to have access to a computer at home (sixty-nine percent vs. forty percent of the boys), were slightly more likely to have used one at school (seventy-seven percent vs. sixty-seven percent), and were more likely to have taken other computer classes (sixty-two percent vs. fifty percent). Not only did these girls' computer experience differ from that of the boys, it also differed from that reported by girls enrolled in the fall/winter sessions for the "talented and gifted" (only forty-two percent of the latter had used a computer at home, for example). Interestingly, during both sessions far fewer girls than boys reported that they had used a computer at the Science Museum. This data suggests that: (1) computer classes at the Science Museum of Virginia are attracting primarily those who already have ample opportunities to interact with computers; and (2) girls (even more so than boys) tend not to be enrolled in such classes unless they are already considered "gifted" or are already in a fairly computer-rich environments.

Obviously, other data collection strategies must be employed for more informal computer situations. Frequency of use by age, sex, or race can be monitored by observation alone; additional information can be collected via intermittent surveys or interviews.

More detailed analysis of baseline interaction patterns is also possible and desirable. Although we all speak glowingly of the popularity of computers in our exhibit areas, little is known about how different populations interact with them. It is also important to examine the ways in which computers affect interactions with related exhibitry and compare interactions with computers with those involving other types of participatory devices at exhibits.

This baseline data gathering should indicate variables that are worth further investigation. School-based research has also isolated variables that might be tested in the museum environment. For example, it has been demonstrated that girls highly value opportunities for social interactions (Lockheed and Frakt 1984) and may thus avoid computer interactions when they are perceived as being solitary activities. Computers might thus be installed in exhibits or computer labs in ways that promote (rather than discourage) social and cooperative interactions.

Format

Despite the widespread popularity of the "game" format, little is known about its relative effectiveness in conveying information. Its motivational power is indisputable, and those characteristics which seem most salient

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(challenge, fantasy, and curiosity) may very well contribute to increased learning (Malone 1981). Nevertheless, it remains to be demonstrated exactly what kinds of information or skills are best communicated via the game format. It may be that using computer games as educational devices, or even labeling a computer activity as a "game," may do nothing more than promote the development of good game playing skills, skills which may or may not be related to the program's intended objectives. As educational computer games continue to proliferate it is essential that both formal and informal educators better assess their effectiveness.

I have briefly outlined only two research possibilities—there are countless more. In considering the research possibilities one must not lose sight of the computer's great potential as a research tool as well. As Korn (1985) points out, computers can easily collect and analyze detailed information on visitors and their interactions with the computer at the same time that the visitor is being entertained and educated. Many computer programs currently in place in museums across the country could be fairly easily modified to collect at least rudimentary information about users. Such a limited research effort would demand little in the way of resources but would at least begin the accumulation of a much-needed data base.

Obviously, however, a more sophisticated approach is also called for. It is unnecessary for every museum to undertake such a research program, but it is essential that those who do carry out systematic investigations communicate their results to their museum colleagues. Publication in widely circulated museum or education journals is one obvious avenue, but even unpublished manuscripts may be (in fact, should be) submitted to the Educational Resources Information Center (ERIC) for inclusion in its database. Despite its easy accessibility and established distribution network, museum professionals have not used the ERIC database to its full potential.

This paper opened with an exhortation to research and it will close with one as well, this time one written sixteen years later. One can only hope that this time the recommendation will be taken more seriously:

"We should not seek the 'best' way of using the computer in learning. The computer can be used in many different ways to aid many different aspects of the learning process. None of these should be eliminated at the present time, when our experience with first rate use of the computer is still extremely limited. Decisions should be based on empirical grounds, rather than on the basis of philosophical positions. We need to use the principles of science in deciding where computers can best be used in the learning process." (Bork 1984, p. 178)

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